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SWINE IMPROVEMENT
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PROGRAM AID 1157
UNITED STATES
DEPARTMENT
OF AGRICULTURE
EXTENSION SERVICE

GUIDELINES FOR UNIFORM SWINE IMPROVEMENT PROGRAMS

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ACKNOWLEDGMENTS

This publication outlines and encourages the use of uniform procedures for objectively measuring and recording swine performance data. These procedures can help improve the value of performance testing as a management tool.

The National Swine Improvement Federation (NSIF) in cooperation with the Extension Service (ES) and the Agricultural Research Service (ARS) sponsored the development of this publication.

Many state Extension specialists, researchers, and swine producers across the country participated on NSIF committees contributing to its contents. Special appreciation is extended to Dr. Roger J. Gerrits, Staff Scientist, Swine Production, National Program Staff, ARS, U.S. Department of Agriculture; and Dr. Irvin T. Omtvedt, Chairman, Department of Animal Science, University of Nebraska, for their assistance in compiling and critically evaluating the information in this publication.

Special acknowledgments are also due the progressive leadership of the 38 swine industry organizations that have placed swine performance testing in its proper perspective by federating to encourage its use by producers.

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GUIDELINES FOR UNIFORM SWINE IMPROVEMENT PROGRAMS

FOREWORD

Research on the use of objective measurements for evaluating swine performance shows that many of the economically important traits have a sufficiently high heritability to provide a sound basis for selection. Formal performance testing programs for swine began in the United States in the 1950's. Performance standards were soon developed for basically all breeds of swine, and 43 central swine testing stations were established in 27 States during the period from 1950 to 1975.

Since these programs were developed independently, numerous variations have developed between programs in terminology, procedures, and methods of measuring and reporting performance information. This lack of uniformity is recognized by the swine industry as a barrier to acceptance and implementation of performance testing. It has restricted cooperation among the various segments of the swine industry in compiling and utilizing performance records and, therefore, restricted the potential genetic and economic impact of performance testing for the swine industry.

This need for standard methods of measuring and reporting swine performance data resulted in the organization of the National Association of Swine Testing Stations (NASTS) in 1974 for the purpose of developing uniform standards for reporting swine performance data. On the basis of discussions and committee reports evolving from meetings of this organization, agreement on uniform guidelines for swine improvement within the swine industry became a distinct possibility. However, for such guidelines to be acceptable by the total swine industry, they would need to be formulated by a broad-based federation encompassing all organizations involved in swine performance recordkeeping.

NASTS prepared bylaws for a federation of national organizations involved in swine performance testing to develop guidelines for uniform swine improvement programs. On

March 20, 1975, these organizations met at the American Pork Congress in Kansas City, Missouri, and approved the bylaws. This dissolved the National Association of Swine Testing Stations (NASTS), forming the National Swine Improvement Federation (NSIF). The purposes of NSIF are:

Uniformity: To work for establishment of accurate and uniform procedures for measuring and recording data concerning the performance of swine which may be used by participating organizations.

Development: To assist member organizations and/or their affiliates in developing their individual programs consistent with the needs of their members and the common goal of all recordkeeping programs.

Cooperation: To develop cooperation among all segments of the swine industry in compilation and utilization of performance records to improve efficiency in the production of swine.

Education: To encourage members to develop educational programs emphasizing the use and interpretation of performance data in improving the efficiency of swine production.

Confidence: To develop increased confidence of the swine industry in the economic potential of performance testing.

Member organizations include:

The national registry associations for 7 breeds of swine: American Berkshire Assn., American Landrace Assn., American Yorkshire Club, Inc., Chester White Swine Record Assn., National Spotted Swine Record, and United Duroc Swine Registry.

Central and on-farm swine testing organizations from the following States:

Alabama	- Auburn Testing Station Southeastern Alabama Swine Evaluation Station
Colorado	- Colorado Swine Growers Association
Florida	- Florida Swine Evaluation Center
Georgia	- Georgia Pork Producers Association
Indiana	- Indiana Boar Test Station
Iowa	- Farmland Industries Iowa Swine Producers Association St. Ansgar Test Station
Kansas	- Kansas Swine Testing Station
Louisiana	- Louisiana Testing Station
Michigan	- Michigan Evaluation Station
Minnesota	- Midland Cooperatives, Inc. Minnesota Pork Producers Association
Mississippi	- Mississippi Swine Testing Station
Missouri	- University of Missouri Swine Testing Station NEMO Swine Testing Station NWMO Swine Testing Station
Nebraska	- Nebraska SPF Swine Accrediting Agency SENEK Swine Test Station
North Carolina	- North Carolina Swine Evaluation Station
Ohio	- Pork Improvement Association
Oklahoma	- Oklahoma Swine Breeders Association
Pennsylvania	- Pennsylvania Meat Evaluation Center
South Carolina	- South Carolina Evaluation Center
South Dakota	- South Dakota Evaluation Station
Tennessee	- Middle Tennessee Swine Test Station West Tennessee Swine Test Station
Virginia	- Virginia Evaluation Station

. National Pork Producers Council.

Associate memberships are available to organizations, firms, public agencies, or individuals interested in swine performance programs. Present associate members are: Hog Farm Management and National Hog Farmer.

Ex-officio member organizations are the Extension Service (ES) and the Agricultural Research Service (ARS) of the U.S. Department of Agriculture (USDA).

This publication was developed from reports of research-Extension-industry committees appointed by the Board of Directors of NSIF. It represents an effort on the part of the swine industry to extend the usefulness of performance testing.

The guidelines in this publication will be reviewed periodically and updated as indicated by research, experience, and industry economics.

The National Swine Improvement Federation (NSIF) and the U.S. Department of Agriculture (USDA) intend to show no preference for or discrimination against any individual breed of swine or organization.

INTRODUCTION

This publication outlines procedures for measuring and recording swine performance. It also strives to achieve greater uniformity of terminology and methods of measuring performance traits. This is important in accomplishing rapid and accurate communication fostering cooperation among all segments of the swine industry in compiling and utilizing performance records.

Economic traits of swine include those that contribute to both productive efficiency and desirability of product. Growth rate, feed efficiency, reproductive efficiency, and carcass merit are economic traits of greatest importance. Performance testing offers those engaged in swine production a way of measuring heritable differences among their animals in order to select parents that are expected to transmit their superior performance to their offspring.

Differences in the performance between individual or groups of animals are due to either genetic or environmental causes. The observed or measured performance of each animal in each trait is the result of its heredity and the total environment in which it is produced. Since differences between animals for economically important traits are due in varying degree to genetic reasons, systematic measurements and use of records in selection can increase the rate of genetic improvement for many traits. Genetically superior individuals can be more readily identified when the animals are maintained under the same management systems and their performance records are adjusted for known environmental differences. There are also many random or chance environmental variables that may contribute to errors in estimating breeding values of animals on the basis of their own performance.

The rate of genetic improvement is dependent on: (1) the percentage of observed differences between animals that is due to genetic causes (heritability), (2) the difference between selected individuals and the average of the herd or group from which they come (selection differential), (3) the genetic association among the traits upon which selection is based (genetic correlations), and (4) the average age of parents when the offspring selected for the next generation are born (generation interval).

Records of performance are primarily useful in providing a basis for comparing swine managed alike within a herd. Large environmental differences due to location, management, health,

and nutrition are likely to exist between herds or between different management groups within herds. Genetic differences between herds do exist, but only through a carefully controlled evaluation can these differences be assessed. To identify high-ranking individuals within a breed, it is necessary to first identify high-ranking individuals within herds. Thus, widespread use of performance testing within herds is the first essential step to swine improvement.

The principal features of effective record of performance programs are:

1. All animals of a given sex and age are given equal opportunity to perform through uniform feeding and management.
2. Systematic records of economically important traits on all animals are maintained.
3. Records are adjusted for known sources of variation.
4. Records are used in selecting replacements (boars and gilts) and in eliminating poor producers.
5. The nutritional regime and management practices are practical and comparable with those where the progeny of the selected parents are expected to perform.

Fertility and the various components that contribute to it have been found to be of low heritability. However, fertility is economically the most important trait in the swine industry.

Extremely low fertility or sterility are self-eliminating, but animals of this kind need to be identified and eliminated from the herd for purely economic reasons. Thus, maintaining complete records on all sows and fertility records on all boars in the breeding herd is recommended. Replacement animals should be selected from parent stocks that have above-average fertility.

Throughout this publication, the term "ratio" is used to refer to the performance of an individual relative to the average of all animals in the same group. It is calculated as:

$$\frac{\text{Individual's record}}{\text{Average of all animals in the group}} \times 100$$

If a boar gains 2.4 lb. per day while all boars in that sale group gained an average of 2.0 lb. per day, this boar's Gain Ratio would be 120. This means that the boar gained 20 percent faster than the average for his sale group.

The Gain Ratio is a useful device for quickly visualizing the relative rankings of individuals in a group. To some degree, it adjusts for environmental differences between groups. This means that animals in different herds or groups can be compared more validly on the basis of ratios than on the basis of actual records. However, it should be emphasized that between-group comparisons, whether expressed as ratios or in actual values, should be kept to a minimum in evaluating and selecting breeding stock.

RECORD STANDARDIZATION AND UTILIZATION

Environmental differences make it difficult to compare pigs tested at different locations, at different times, and under different forms of management. However, the use of a standard index based on contemporary group comparisons and index ratio expression of traits removes the influence of some of these environmental factors and permits more valid comparisons.

INDEX STANDARDIZATION

1. It is recommended that only boars be tested in central test stations in full sib groups because of increased accuracy of feed efficiency data. If full sib groups are not used, all boars in a test pen must at least be from the same sire (potential half-sibs) or the index will not be applicable.
2. All test stations should use the appropriate index.
3. Traits used in calculating the index shall be:
 - a. DG = Boar's test daily gain.
 - b. \overline{DG} = Average test daily gain for all boars in test-sale group.
 - c. F/G = Pen feed conversion for boar or pen of boars.
 - d. $\overline{F/G}$ = Average pen feed conversion for all boars in test-sale group.
 - e. BF = Boar's adjusted backfat probe or sonoray.
 - f. \overline{BF} = Average adjusted backfat probe or sonoray for all boars in test-sale group.
4. The index will be calculated by subtracting test-sale group average for DG, F/G, and BF from the boar's record for these traits, multiplying each difference by an appropriate weighting factor, then adding 100 to the resultant value, as follows:

- a. The index for a test pen including one boar only is:

$$100 + 45 (DG - \overline{DG}) - 65 (F/G - \overline{F/G}) - 60 (BF - \overline{BF})$$

- b. The index for a test pen of other than one boar is:

$$100 + 60 (DG - \overline{DG}) - 75 (F/G - \overline{F/G}) - 70 (BF - \overline{BF})$$

- c. Index to be used at test station or on-the-farm where boars and/or gilts are group fed and no feed efficiency data is available:

$$100 + 110 (DG - \overline{DG}) - 105 (BF - \overline{BF})$$

These indexes will average 100 for each test or sale group with a standard deviation of 25. This means that two-thirds of the boars will fall between 75 and 125 index points. About one-sixth (16 percent) of the boars would be expected to index over 125 points, and about one-sixth would be expected to index under 75 points.

5. Report boar's ratios for all traits measured (DG, F/G, and BF). The actual individual figures for DG, F/G, and BF may also be reported. Additional traits measured such as loin eye area, visual score, percent ham and loin, percent lean cuts, and soundness may be reported but not used in the index.
6. Summary reports and sale catalogs should include test-sale group averages for all traits measured, including all boars in test-sale group (including those not making sale).
7. Do not use independent culling levels except for soundness. Offer for sale only boars with a minimum Index ratio of 80 or higher. This will result in approximately 20 percent of all boars' being culled on index. Stations may adopt higher standards.

COMPUTER STANDARDIZATION

1. Computer programs should be developed for processing central test station and on-the-farm records.
2. Standardized data sheets should be developed for (a) central test stations and (b) on-the-farm testing programs. An example is shown in Appendix 1.
3. A common computer program should be developed which utilizes standard form inputs and produces standard outputs.

4. The computer programs should be available for adaptation to local computers so that end-of-test results can be computed at the local level.
5. Computer records for pigs from central test stations should be maintained centrally for (a) producing national summaries and (b) subsequent data analysis.

SPECIFIC TRAIT STANDARDIZATION

1. Use actual daily gain for adjusting days to 230 lb. for both test stations and on-the-farm tests.
2. Backfat thickness adjustments should be based on the backfat thickness and weight at the end of the test. These adjustments can be made by using the adjustment table provided in Appendix 2. It is strongly recommended that all test stations and on-the-farm testing programs use these standard adjustments for backfat.

NUTRITION AND HEALTH

The nutritional regime of the animal and the health program greatly influence the results of swine testing programs. This section helps establish suitable nutrient levels for desirable performance and outlines a health program for central test stations and on-the-farm operations.

NUTRIENT PROGRAM

1. The ration fed should contain a minimum of:

<u>Nutrient</u>	<u>Percent or amount per lb. of ration</u>
a. Crude protein	18%
b. Metabolizable energy	1400 kcal.
c. Calcium	0.90%
d. Phosphorus (total ration)	0.70%
e. Iodized salt	0.50%
f. Trace minerals (in addition to those from ration ingredients)	
(1) Zinc	56.8 mg. (125 ppm.)
(2) Iron	45.4 mg. (100 ppm.)
(3) Copper	6.8 mg. (15 ppm.)
(4) Manganese	18.2 mg. (40 ppm.)
(5) Selenium	0.04 mg. (0.1 ppm.)
g. Vitamins (in addition to vitamins from diet ingredients)	
(1) Vitamin A	2000.0 I.U.
(2) Vitamin D	400.0 I.U.
(3) Riboflavin	2.0 mg.
(4) Niacin	12.0 mg.
(5) Pantothenic Acid	8.0 mg.
(6) Vitamin B ₁₂	10.0 mcg.
(7) Vitamin E	10.0 I.U.
(8) Vitamin K	2.0 mg.
(9) Choline	100.0 mg.

2. An example of a standard diet is present in Appendix 3.
3. The recommended metabolizable energy (ME) content (1400 kcal./lb.) is approximately 4 percent below the National Research Council (NRC) recommendation. However, most test stations are now using diets that are equal to 1400 kcal. ME per lb. or lower. Fat is not to be added to the diet to reach the NRC recommended energy concentration.
4. It is recommended that an antibiotic that is effective and approved by FDA be used as a feed additive throughout the test period.
5. All diets should be pelleted. Meal-form diets may be more practical for on-the-farm testing programs, but pelleted diets are preferred.
6. If the protein content of the diet is to be reduced at the midpoint of the test, a 16-percent crude protein diet should be fed thereafter.
7. Boars should not be allowed feed ad libitum after conclusion of the test. (See Reproduction section.)

HEALTH PROGRAM

1. Central Test Stations

- a. All entries to a test station should be from a validated brucellosis-free herd. Both the breeder and his veterinarian should certify that the herd has been free of clinical evidence of: TGE, swine dysentery, pseudorabies, tuberculosis, and brucellosis during the 6-month period before entry of the pigs at the test station. Entries must be accompanied with the certification statement (Appendix 4) and a current interstate health certificate.
- b. All animals should be tested for brucellosis before sale.
- c. Pigs should be vaccinated for erysipelas and five strains of leptospirosis (pomona, canicola, grippotyphosa, hardjo, and icterohaemorrhagiae) upon entry into the station and again before sale.

- d. Test animals should be wormed with a compound that has been proven effective for control of internal parasites during the adjustment period before starting on test.
- e. Pigs should be treated for external parasites with an approved product upon entry into the station, 2 weeks later, and before sale.
- f. If barrows are tested, pigs should be well healed from castration before acceptance into the station.
- g. A poster (Appendix 5) is to be displayed at test stations to inform visitors, including buyers, of the established health program or requirements.
- h. The following procedures are suggested for station operation:
 - (1) Move all pigs directly from farm of origin to the test station.
 - (2) Provide all visitors with station boots and coveralls during their visit.
 - (3) Allow no one to enter pens.
 - (4) Allow no visitors in pen area for 35 days after pigs are delivered.
 - (5) Establish a policy that the attending veterinarian may choose a live pig for post-mortem examination to aid in arriving at a diagnosis in disease outbreaks.
 - (6) Work closely with station veterinarian on establishing sanitation procedures.
 - (7) Permit no visitors unless an attendant is present.

2. On-The-Farm Testing

The following items are herd health recommendations for on-farm testing programs.

- a. All seedstock producer herds should be validated brucellosis free.

- b. All pigs sold should be vaccinated for erysipelas and 5 strains of leptospirosis, should be free of external parasites, and should have been subjected to a reasonable worming program. (See c. and d. in previous section "Central Test Stations.")
- c. All pigs sold should be eligible for an interstate shipment permit.
- d. Strict sanitation measures should be followed for all incoming traffic such as scanning equipment, feed trucks, stock trucks, boar buyers, etc. Each farm should have its own scales.

TESTING PROCEDURES

CENTRAL TEST STATION

Central swine testing stations are locations where animals are assembled from several cooperating farms to evaluate differences in some performance traits under uniform conditions. They are used primarily: (1) for comparing the individual performance of potential seed stock boars with performance of similar animals from other herds for rate of gain, feed conversion, backfat, and estimates of muscle; and (2) as an educational tool to acquaint breeders with performance records.

Central swine testing station objectives should be clearly defined and procedures to accomplish the objectives should be followed. The most a central test station can offer is reliable records for comparisons within test and within year.

Entry Requirement -- Individual Pig Basis

1. Entry weight -- 40 to 60 lb.
2. Entry weight per day of age range -- .60 to 1.2 lb. per day of age.
3. There will be a minimum of a 7-day adjustment period from entry into the station to "on test" weight.
4. The "on test" weight will be 70 ± 5 lb. per pig pen average.
5. Pedigrees for purebred boars being tested must be in the hands of the station manager by the 35-day weighing. If papers are not in the hands of the manager at that time, pedigree information will not be cataloged.
6. All pigs entering the test stations must be from brucellosis-free validated herds and accompanied by the entry certificate on Page 34 (Appendix 4).
7. A test pen may consist of 1, 2, 3, or 4 animals from 1 sire representing a maximum of 2 litters.
8. Animals are to be tested by class; i.e., all boars, gilts, or barrows are to be tested in separate groups or pens.

Records and Reporting

Required data to be reported by Central Testing Stations and included in sale catalogs are:

1. "On test" weight, date, age, and weight per day of age on a per pig basis.
2. Daily gain.
3. Backfat.
4. Feed conversion.
5. Optional information may include loin eye estimate and other estimates of muscle or soundness.

The performance of all classes of animals will be adjusted to 230 lb. using the adjustment factors found in the Standardization and Utilization section.

Test weight range will be 220 to 240 lb.

A 35-day report is to be sent to the consignor. This report will provide information on weight, average daily gain to date, and other pertinent data that the manager may wish to include. This report will state that the information is not to be used in sale or advertising promotion.

Breed secretaries should be appraised of the consignors "on test" at the station, breeds represented, and also sale dates of the test group.

Test Station Procedures

1. Information regarding each test pen should be posted at the test pen site. The pen card should include:
 - a. Name and address of consignor.
 - b. Sire name of pigs.
 - c. Farrowing dates of pigs.
 - d. "On test" date.

2. Feed conversion is to be figured on an average pen weight of 230 lb.

Sale Qualifications and Reports

1. Independent culling levels will not be used in determining animal's acceptance in the sale.
2. Only boars with an index ratio of 80 percent or higher will be offered for sale. This will result in approximately 20 percent of all boars being culled.
3. Additional animals may be culled because of soundness or other considerations.
4. Indexes used will be those in the Record Standardization and Utilization section.
5. Information will be reported on all animals that enter the test station regardless of whether they are eligible to sell or not.
6. The test catalog will report the index, daily gain, backfat, and feed conversion as well as ratios for these characteristics. In addition, optional traits of loin eye estimates and soundness scores may be presented.
7. The test sale group averages, that include all boars completing test, will be reported.
8. Boars are not to be removed for show after catalog is printed.

Handling Boars After Completion of Test

Refer to recommendations for off-test management of young boars in the Reproduction section.

ON-FARM TESTING

Purpose

The primary purpose of an on-farm performance swine testing program is to measure the performance of individuals and to use these performance records as the basis for selection and genetic improvement within the herd.

The on-farm testing program is designed to assist breeders in evaluating their herds in a systematic manner. The program will identify superior individuals, strains, lines, or breeds; assist breeders in the selection of boars and gilts; provide a means of following up on the breeding value of boars purchased from central test stations; and allow breeders to use a common language and guidelines in selection of breeding stock.

Supervision

The National Swine Improvement Federation (NSIF), acting as coordinating organization, will recommend guidelines for on-farm swine testing. The member organizations -- comprised of breed organizations, state swine testing organizations, commercial performance organizations, and Cooperative State Extension Services -- will supervise the program. Since a common language and data collection system will be developed, an exchange of data should be implemented. Thereby, a breeder enrolled in a breed's on-farm program could simultaneously be enrolled in the state program, or vice versa.

Participation

Any swine breeder who meets the minimum eligibility requirements may participate in the on-farm testing program. Breeders participating in the program must meet certain minimum performance testing criteria, but may develop a more comprehensive testing program that best meets their individual needs.

Testing Essentials

Since the on-farm testing program is designed for within herd genetic improvement, the greatest value will be gained when the whole herd is enrolled in the program and all pigs are evaluated.

As with test station records, accuracy is an extremely important component of the on-the-farm program. In an effort to aid the producer in the mechanics, record processing and reporting the use of technical services available from breed associations, Cooperative State Extension Services, state swine testing organizations, and private commercial concerns are encouraged.

Pigs should be evaluated within test groups and divided by farrowing group, month, or season. These test groups should be uniformly managed and fed. All pigs in the test group should be given an equal opportunity.

Although a pig's actual weight and record are important, each record should be expressed as a ratio of the test group or herd average. The individual's ratio for a given trait should be used when ranking possible herd replacements. Since environmental factors may influence the test group or herd average, the actual weight record may be biased; therefore, these data may be reported, but could be misleading.

Testing Procedures

Participating breeders in on-farm testing programs should meet the following minimum criteria:

1. Identification of All Pigs in Herd. Since a uniform ear notching system has become standard throughout the swine industry, NSIF recommends the ear notching system which identifies the litter in the right ear and individual pig in the left ear. The most common number system used is the 1-3 bottom notch, 9-27 top, and 81 end of ear notch (Appendix 6). If another notching system is used, the appropriate system should be stated and attached to the basic record document. Supplemental identification of ear tags or tattoos may be used as optional herd identification.
2. Birth Record. All pigs will be individually ear notched, sex noted within 3 days of birth, and the birth date and parents recorded in an appropriate record book or file kept by the breeder. These records are essential.
3. Sow Productivity Record. Record the number of pigs farrowed. This should include all pigs born alive or dead, but only those pigs that are fully formed at birth. An optional record of number of pigs born alive, dead, or mummified may be recorded.

Record the number of pigs alive at 21 days. Since the weaning age is variable from breeder to breeder, the standard NSIF weigh date will be 21 days for uniformity of recording purposes. An individual breeder may wean at any time, but the data must be collected at 21 days.

Additional sow productivity measurements are listed in the Reproduction section.

4. Post-Weaning Record

- a. Age at 230 lb. Pigs should be weighed between 200 and 260 lb. and adjusted to a 230-lb. basis. These weights will be reported along with a weight ratio.

$$\text{230-lb. age ratio (AR)} = \frac{\text{Individual age at 230 lb. (adj.)}}{\text{Avg. test group age at 230 lb. (adj.)}} \times 100$$

The NSIF recommends all data to be reported to a 230-lb. basis. The recommended NSIF age adjustments to 230 lb. will be 2 lb. per day.

Optional post-weaning gain records:

- (1) Age at heavier weight - Breeders must report the adjusted 230-lb. weight ratio for industry standardization. However, some breeders may test to different weights because of breed or individual breeder's objectives. These records may be reported along with the ratio of the test group.
- (2) Weight to given age or weight per day of age - Because of the logistics of weighing pigs, some organizations use a set number of days for evaluating pigs, such as 140 or 150-day weight. NSIF recommends these weights and ratios be reported as well as the standard adjusted 230-lb. weight ratio.
- (3) 80-day gain test - All pens of pigs will be weighed on official test at an average pen weight between 40 and 60 lb. with a range of 30 to 80 lb. for individual pigs. All pigs will be weighed off-test after an 80-day test.

Test daily gains will be reported along with the gain ratio. If the pig's actual weight is between 200 and 260 lb., the adjusted 230-lb. weight ratio will be reported.

- b. Body Composition Record. All pigs will be measured for backfat thickness. Backfat will be evaluated on pigs weighing between 200 and 260 lb. and adjusted to 230 lb. Adjusted backfat will be reported along with the ratio. The recommended NSIF backfat adjustment table is listed in Appendix 2.

Optional body composition records:

- (1) If testing is to be conducted to heavier weights or to standard days of age, the same procedures will be followed as recommended for weight evaluation. All backfat data should be reported to a national standardization 230-lb. weight along with the BF ratio.
- (2) Loin eye area data should be evaluated on pigs weighing between 200 and 260 lb. and adjusted to 230 lb. Adjusted loin eye area will be reported along with ratio of the test group. The recommended NSIF loin eye area adjustments will be 0.015 square inches per pound.
- (3) Samples of market pigs may be slaughtered for carcass evaluation. (See the Carcass Evaluation section for procedures.)

- c. Feed Conversion Record -- Optional. Feed conversion records are optional for breeders because of the possible inability to collect these records.

- (1) If feed conversion records are collected, the initial weight on test will be between 40 and 60 lb. with a range of 30 to 80 lb. Average off test weight should be 230 lb. for the test group, with a range of 200 to 260 lb. for individual pigs.

Pigs should be evaluated individually by litter or sire progeny groups, depending on the breeder's facilities. Sire progeny groups may be grouped by sex. The feed conversion data should be recorded along with ratios of the test group.

5. Health Record. Each breeder should set up a herd health program with his local veterinarian. The health record should include those standards set forth in the Nutrition and Health section.
6. Genetic Abnormalities and Structural Soundness. All breeding stock that exhibit any genetic defect, such as cryptorchidism, genetic hernia, abnormal structural unsoundness, and abnormal reproductive organs, should be reported and culled. Evaluating reproductive soundness is covered in the Reproduction section.

CARCASS EVALUATION

NSIF supports and recommends the use of the carcass contest procedures developed by the National Pork Producers Council. Thus, these procedures will be the basis from which NSIF carcass evaluation guidelines will be developed. Copies of the NPPC carcass evaluation procedures may be obtained from the National Pork Producers Council, 4715 Grand Avenue, Des Moines, Iowa 50312.

REPRODUCTION

The importance of efficient reproductive performance in the economical production of swine cannot be over-emphasized. Thus, guidelines were developed in this section for evaluating reproductive soundness and improving reproductive performance.

OFF-TEST MANAGEMENT OF YOUNG BOARS

1. Minimum age for delivery to buyer -- 5½ months.
2. Minimum age for successful breeding -- 7½ months.
3. Between completion of the performance test and use in breeding, boars should be handled and evaluated as follows in order to maximize their chances for successful breeding.
 - a. All boars should be restricted in energy intake after completing test to prevent unneeded increases in weight and condition. This will insure that boars are physically adept and sexually active. Nutrients other than energy should be provided to meet the daily recommended allowances of the National Research Council.
 - b. Boars tested individually or in small groups in close confinement should be handled to develop physical hardening and to stimulate sexual arousal and libido. Where possible, this should be done before delivery and might include the following:
 - (1) Shifting boars to a different location from where they were tested.
 - (2) Regrouping with other boars in larger pens or outside lots. Boars should be observed closely during the initial period of contact, and ample space should be provided.
 - (3) Providing fence line contact with cycling females. This may be especially important where the aggressiveness of the boars precludes mixing them together.
 - c. Boars tested in large groups and in less confined settings will require less physical conditioning and sexual stimulation before use, but may still benefit from some of

the management procedures described for boars reared in close confinement.

- d. Before or just after delivery, boars should be acclimated to the environmental conditions (dirt, confinement, fluctuating temperature, sunlight, etc.) they are expected to function in during breeding on the new farm.
- e. Boars should be isolated in clean, comfortable sanitary quarters for a minimum of 30 days after delivery to the farm and before exposure to the breeding herd. After a 2- to 3-day adjustment period to the new environment, procedures should be implemented to:
 - (1) Provide protection against certain major disease organisms. (See Nutrition and Health section for further details.)
 - (2) Maintain and/or further stimulate sexual arousal and drive. Introduction of a few subordinate market barrows or cycling gilts should provide sexual stimulation.
 - (3) Introduce the boar to the microflora present in the pigs on the new farm. Contact with market hogs will insure that the boar(s) are challenged by any new organisms and have sufficient time to recover from any illness caused by the new disease organisms before being used for breeding. The boars and market hogs should both be closely observed during this period for clinical symptoms of disease, including elevated body temperature.
- f. After the period of isolation and before breeding, the boars should be provided 3 to 4 weeks of fence line contact with breeding females in order for the females to contact any new microorganisms brought in by the boar. Early in the contact period, the boar should be evaluated for reproductive soundness.

PROCEDURES FOR EVALUATING REPRODUCTIVE SOUNDNESS OF BOARS

For fair evaluation of reproductive soundness, the testing should begin after 7½ months of age and before the breeding season so problem boars can be identified.

Reproductive soundness can best be evaluated by bringing a gilt that is in standing heat into the boar's pen and observing the following:

Libido: Observe the boar's aggressiveness and desire to mate. Most libido problems are psychological rather than hormonal. Boars that have not experienced fighting, mounting, erection, and general male developmental activity may need assistance through at least one mating experience.

Mounting: Does the boar have the ability to mount correctly? Boars may be interested in mounting, but will not because of lameness, arthritis, or an injury. Boars that mount the front end of a gilt have learned a bad habit and must be gently moved around to the proper position for a few matings.

Mating: Observe the boar's ability to erect and properly enter the gilt. Examine the boar's penis for normal size and condition. Penis abnormalities frequently encountered are: (a) adhered or tied penis, (b) limp penis, (c) infantile penis, and (d) coiling of the penis in the diverticulum. These conditions may be heritable and boars exhibiting these problems should not be used in herds producing replacement stock.

Semen: A few boars do not produce sperm cells; thus, early detection and elimination of these boars are essential. The simplest way to collect semen for a boar is to put a rubber glove (latex) on one hand. Allow the boar to mount a gilt that is in standing heat. Firmly grasp the corkscrew tip of the penis and bring the penis out of the sheath and downward. Collect the entire ejaculate into a pint, wide-mouth insulated container. Cover the opening with a double layer of cheesecloth to keep the gel fraction separate. The semen volume can vary from 100 to 400 ml. If the sperm concentration is high, the semen will be milky in appearance. Boars with watery or bloody semen should be reexamined and the semen evaluated by a reproduction specialist for sperm density, motility, or the presence of infection. Usually 70 to 80 percent of the sperm should be motile immediately after collection. However, low sperm motility is not a serious matter unless the condition persists for several months. Boars that produce semen with no sperm or only a few sperm should be rechecked several times at weekly intervals and not used for matings until sperm production is normal.

Test Matings: To complete the soundness evaluation 2 or 3 gilts should be bred and carefully checked to see whether they return to estrous within 4 weeks. Boars may be exposed to conditions or microorganisms on the new farm which may produce temporary infertility. High environmental temperatures, stress of transportation, illness, lameness, or injuries causing high body temperature can alter sperm motility and reduce fertility for at least 8 weeks after the boar has completely recovered.

Claims of Non-Performance: The buyer should have at least 90 days from date of purchase to claim an adjustment. This period will provide ample time for isolation of the boar, hardening, reproductive soundness evaluation, and test matings.

PROCEDURES FOR IMPROVING SOW PRODUCTIVITY

Minimum Program

1. Select on the basis of litter weight taken at 21 ± 3 days. Adjust the litter weight to 21 days using the average daily litter gain to the day weighed. This allows weights to be taken once a week. For example, a litter weighing 90 lb. at 20 days would have an adjusted 21-day weight of 94.5 lb. Sows should be compared with other sows farrowing in the same group because of environmental conditions common to sows farrowing at the same time.
2. Any transfer of pigs should involve the male only.
3. Mark gilts with 12 or more functional teats and eliminate gilts from litters with defects.
4. Each producer may set his own level of selection for sow temperament, condition of sow, teat count, pig strength, and uniformity of litter.

Expanded Program

The following sow productivity traits are recommended for consideration to maximize genetic progress in improving mothering ability. Combining one or more of these traits into a selection index should improve selection for sow productivity.

1. Litter birth weight -- determine as soon after farrowing as possible.

2. Number born per litter -- determine as soon after farrowing as possible. Include fully formed live or dead pigs, but not mummified pigs.
3. Litter weight -- weights at 21 ± 3 days and adjust to 21 days using the average daily litter gain to the day weighed.
4. Litter size at 21 days.
5. Farrowing ease score -- scale 1 to 3, assuming natural birth receiving no outside stimulus.

Score of 3 -- equals the best with the average farrowing interval of less than or equal to 20 minutes per pig and less than or equal to 10 percent dead pigs or ≤ 3 hours farrowing time and no more than 1 dead pig.

Score of 2 -- between 20 and 30 minutes farrowing interval per pig and between 10 and 20 percent dead pigs or a 5-hour total farrowing time and ≤ 2 dead pigs.

Score of 1 -- greater than a 30-minute farrowing interval per pig and greater than 30 percent dead pigs or more than 5 hours in total farrowing time and 3 or more dead pigs.

Female Month Breeding Herd System

This system evaluates total herd production, requires monthly inventories of the breeding herd, and permits calculations of number of pigs and number of litters produced per sow per month or per year.

$$\begin{array}{l} \text{Sow Herd Productivity} \\ \text{Per Sow Per Year} \end{array} = \frac{\text{Total Number of Pigs at 21 Days}}{\text{Sum of the Monthly Sow Inventories}/12}$$

$$\begin{array}{l} \text{Sow Herd Productivity} \\ \text{Per Sow Per Month} \end{array} = \frac{\text{Sow Herd Productivity Per Sow Per Year}}{12}$$

PROCEDURES FOR EVALUATING REPRODUCTIVE SOUNDNESS OF GILTS

During performance testing, gilts are generally fed for maximum growth and feed efficiency. At the end of the performance test, energy intake of all gilts should be restricted to prevent overweight conditions that reduce reproductive performance. Nutrients

other than energy should be provided to meet the daily recommended allowances of the National Research Council.

Onset of puberty: Movement of gilts to new pens, increased exercise, and daily exposure to boars beginning between 160 and 180 days of age will help stimulate the onset of estrous in gilts. Breeding should be delayed until the second or third estrous to increase the probability of large litters.

Reproductive soundness: About 10 percent of gilts have abnormal reproductive organs. Some of these can be detected and eliminated before breeding.

1. An infantile vulva indicates the gilt has an undeveloped reproductive tract.
2. An upturned to "tipped" vulva may indicate an abnormal tract. Boars also have difficulty serving these gilts.
3. Underlines should be re-evaluated to provide at least 12 functional teats.

Gilts that do not conceive after mating at two estrous periods should be marketed. They may have abnormal tracts or perpetuate breeding problems.

MERCHANDISING

Effective merchandising depends on the integrity of the breeder, coupled with the use of well-defined terms relating to the product to be sold. Standardized terminology relative to swine improvement has been developed through NSIF. Use of standard terms found in this publication is very important for communication throughout the swine industry and is strongly encouraged by NSIF in advertising and merchandising performance-tested swine.

NSIF strongly opposes the use of misleading statements which may be deceptive, make impossible claims, or use only selected portions of the total record in the merchandising of performance-tested swine. The use of misleading information is detrimental to the whole concept of performance testing. Therefore, NSIF strongly recommends that member organizations exert every possible effort to inform and educate swine producers to use NSIF recommended standards in advertising and merchandising their performance-tested swine.

BREED	BREEDER	ADDRESS	ZIP CODE	PEN
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APPENDIX 2: ADJUSTED AVERAGE BACKFAT TO 230 LB. (INCHES)

Total of 3 BF's (inches)	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280
1.2	.48	.47	.46	.46	.45	.44	.43	.42	.42	.41	.40	.39	.38	.38	.37	.36	.35	.34	.34	.33	.32
1.3	.52	.51	.50	.49	.49	.48	.47	.46	.45	.44	.43	.42	.41	.41	.40	.39	.38	.37	.36	.36	.35
1.4	.56	.55	.54	.53	.52	.51	.50	.49	.49	.48	.47	.46	.45	.44	.43	.42	.41	.40	.39	.38	.37
1.5	.60	.59	.58	.57	.56	.55	.54	.53	.52	.51	.50	.49	.48	.47	.46	.45	.44	.43	.42	.41	.40
1.6	.64	.63	.62	.61	.60	.59	.58	.57	.55	.54	.53	.52	.51	.50	.49	.48	.47	.46	.45	.44	.43
1.7	.68	.67	.66	.65	.63	.62	.61	.60	.59	.58	.57	.56	.55	.53	.52	.51	.50	.49	.47	.46	.45
1.8	.72	.71	.70	.68	.67	.66	.65	.64	.62	.61	.60	.59	.58	.56	.55	.54	.53	.52	.50	.49	.48
1.9	.76	.75	.73	.72	.71	.70	.68	.67	.66	.65	.63	.62	.61	.60	.58	.57	.56	.54	.53	.52	.51
2.0	.80	.79	.77	.76	.75	.73	.72	.71	.69	.68	.67	.65	.64	.63	.61	.60	.59	.57	.56	.55	.53
2.1	.84	.83	.81	.78	.78	.77	.76	.74	.73	.71	.70	.69	.67	.66	.64	.63	.62	.60	.59	.57	.56
2.2	.88	.87	.85	.84	.82	.81	.79	.78	.76	.75	.73	.72	.70	.69	.67	.66	.65	.63	.62	.60	.59
2.3	.92	.90	.89	.87	.86	.84	.83	.81	.80	.78	.77	.75	.74	.72	.71	.69	.67	.66	.64	.63	.61
2.4	.96	.94	.93	.91	.90	.88	.86	.85	.83	.82	.80	.78	.77	.75	.74	.72	.70	.69	.67	.66	.64
2.5	1.00	.98	.97	.95	.93	.92	.90	.88	.87	.85	.83	.82	.80	.78	.77	.75	.73	.72	.70	.68	.67
2.6	1.04	1.02	1.01	.99	.97	.95	.94	.92	.90	.88	.87	.85	.83	.81	.80	.78	.76	.75	.73	.71	.69
2.7	1.08	1.06	1.04	1.03	1.01	.99	.97	.95	.94	.92	.90	.88	.86	.85	.83	.81	.79	.77	.76	.74	.72
2.8	1.12	1.10	1.08	1.06	1.05	1.03	1.01	.99	.97	.95	.93	.91	.90	.88	.86	.84	.82	.80	.78	.77	.75
2.9	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.02	1.01	.99	.97	.95	.93	.91	.90	.87	.85	.83	.81	.79	.77
3.0	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.02	1.00	.98	.96	.94	.92	.90	.88	.86	.84	.82	.80
3.1	1.24	1.22	1.20	1.18	1.16	1.14	1.12	1.10	1.07	1.05	1.03	1.01	.99	.97	.95	.93	.91	.89	.87	.85	.83
3.2	1.28	1.26	1.24	1.22	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.02	1.00	.98	.96	.94	.92	.90	.87	.85
3.3	1.32	1.30	1.28	1.25	1.23	1.21	1.19	1.17	1.14	1.12	1.10	1.08	1.06	1.03	1.01	.99	.97	.95	.92	.90	.88
3.4	1.36	1.34	1.31	1.29	1.27	1.25	1.22	1.20	1.18	1.16	1.13	1.11	1.09	1.07	1.04	1.02	1.00	.97	.95	.93	.91
3.5	1.40	1.38	1.35	1.33	1.31	1.28	1.26	1.24	1.21	1.19	1.17	1.14	1.12	1.10	1.07	1.05	1.03	1.00	.98	.96	.93
3.6	1.44	1.42	1.39	1.37	1.35	1.32	1.30	1.27	1.25	1.22	1.20	1.18	1.15	1.13	1.10	1.08	1.06	1.03	1.01	.98	.96
3.7	1.48	1.46	1.43	1.41	1.38	1.36	1.33	1.31	1.28	1.26	1.23	1.21	1.18	1.16	1.13	1.11	1.09	1.06	1.04	1.01	.99
3.8	1.52	1.49	1.47	1.44	1.42	1.39	1.37	1.34	1.32	1.29	1.27	1.24	1.22	1.19	1.17	1.14	1.11	1.09	1.06	1.04	1.01
3.9	1.56	1.53	1.51	1.48	1.46	1.43	1.40	1.38	1.35	1.33	1.30	1.27	1.25	1.22	1.20	1.17	1.14	1.12	1.09	1.07	1.04
4.0	1.60	1.57	1.55	1.52	1.49	1.47	1.44	1.41	1.39	1.36	1.33	1.31	1.28	1.25	1.23	1.20	1.17	1.15	1.12	1.09	1.07
4.1	1.64	1.61	1.58	1.56	1.53	1.50	1.48	1.45	1.42	1.39	1.37	1.34	1.31	1.28	1.26	1.23	1.20	1.17	1.15	1.12	1.09
4.2	1.68	1.65	1.62	1.60	1.57	1.54	1.51	1.48	1.46	1.43	1.40	1.37	1.34	1.32	1.29	1.26	1.23	1.20	1.18	1.15	1.12
4.3	1.72	1.69	1.66	1.63	1.61	1.58	1.55	1.52	1.49	1.46	1.43	1.40	1.38	1.35	1.32	1.29	1.26	1.23	1.20	1.18	1.15
4.4	1.77	1.73	1.71	1.68	1.65	1.62	1.59	1.56	1.53	1.50	1.47	1.44	1.41	1.38	1.35	1.32	1.29	1.26	1.23	1.20	1.17
4.5	1.80	1.77	1.74	1.71	1.68	1.65	1.62	1.59	1.56	1.53	1.50	1.47	1.44	1.41	1.38	1.35	1.32	1.29	1.26	1.23	1.20

NOTE: Table takes into account that lean and fat pigs deposit fat at different rates. Formula for adjusting in computer programs: Adjusted BF = ((230 - Actual wt.) x .004) + 1.0) x Unadj. Avg. BF.

APPENDIX 3: EXAMPLE TEST STATION DIET FORMULA 1/

<u>Ingredient</u>	<u>Amount</u> <u>(lb./ton)</u>
Ground yellow corn (8.9% crude protein)	1283.0
Soybean meal (44% crude protein)	555.0
Molasses <u>2/</u>	25.0
Pellet Binder <u>2/</u>	50.0
Dicalcium phosphate (24% Ca; 18.5% P)	35.0
Ground limestone (38% Ca)	20.0
Salt (iodized)	10.0
Trace mineral mix <u>3/</u>	2.0
Vitamin mix <u>4/</u>	20.0
	<hr/> 2000.0

1/ Calculated analysis: 17.9% crude protein; 0.89% calcium; 0.70% phosphorus; and 1381 kcal. metabolizable energy/lb. of diet (calculations considered corn as the carrier for vitamins).

2/ Molasses and pellet binder level may be varied according to needs for proper pelleting.

3/ Amount of trace mineral mix used may vary but should add 125 ppm. zinc, 100 ppm. iron, 15 ppm. copper, 40 ppm. manganese, and 0.1 ppm. selenium per pound of complete feed.

4/ Amount of vitamin mix may vary but should add the following vitamins/ton of complete feed: Vitamin A - 4,000,000 I.U.; Vitamin D - 800,000 I.U.; Riboflavin - 4.0 gm.; Niacin - 24 gm.; Calcium Pantothenate - 16 gm.; Vitamin B₁₂ - 20 mg.; Choline - 200 gm.; Vitamin E - 20,000 I.U.; and Menthione Sodium Bisulfite (or equivalent Vitamin K source) - 4.0 gm. Antibacterial agents are to be added at approved levels.

APPENDIX 4: TEST STATION HEALTH RECORD

Dear Producer:

We are asking you to complete the following health history questionnaire regarding your breeding herd. The certificate must be signed by a veterinarian who is regularly involved with your swine health program.

This health certification statement must be returned with the contract of entry for the test station. Since valuable breeding animals will be gathered together into a new group, we must take all precautions necessary to protect the health of these animals. The spread of an infectious disease from the test station to a farm which purchased boars from the test station would be detrimental for everyone involved. In the event your boars perform well in the test station and a demand is created for your stock, we want assurance that other animals in your herd possess the same level of health as the test station swine.

We recognize that conditions change daily, but we consider this history important for the preservation of good will and integrity for the seed stock industry.

Please answer the questions concerning the specific diseases listed. Answer all with either yes or no. These answers will be considered confidential, but may be a basis for rejection of an entry.

Have any pigs on your farm been infected with any of the following diseases within the last 6 months?

_____ TGE	_____ Tuberculosis
_____ Swine dysentery	(any slaughter house condemnation)
_____ Brucellosis	_____ Pseudorabies

Does your herd have any current problem with

_____ Rhinitis	_____ External parasites
_____ Erysipelas	_____ Acute pneumonia

_____ Have you had your herd inspected for the above diseases and/or conditions within the last 2 weeks by your local veterinarian?

I attest that the above information is true.

Date

Producer's signature and address

I have this day inspected the breeding herd of origin and find the herd to be suitable for consideration for entry into the test station. I am regularly employed by the above client for veterinary services.

Date

Veterinarian's signature and address

APPENDIX 5: ESTABLISHED HEALTH PROGRAM OR REQUIREMENTS

F O R Y O U R P R O T E C T I O N

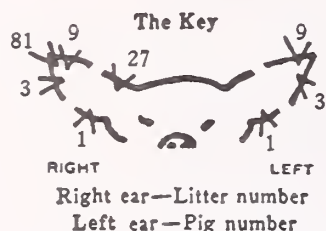
All swine entered in this station have been subjected to the following:

- ✓ Six months prior to entry the herd of origin had no clinical evident of - TGE, swine dysentery, pseudorabies, tuberculosis, and atrophic rhinitis.
- ✓ Originated from a Validated Brucellosis-Free Herd or State.
- ✓ Vaccinated for erysipelas and 5 strains of leptospirosis upon entry, and again prior to sale.
- ✓ Wormed prior to starting on test.
- ✓ Treated for external parasites upon entry and prior to sale.

I N T E R S T A T E S H I P M E N T P E R M I T
A V A I L A B L E F O R A L L P I G S S O L D

APPENDIX 6: EAR NOTCHING SYSTEM

Ear Notching System To Identify Litters And Pigs In Litter



Litter Mark: Right ear is used for litter mark and all pigs in same litter must have the same ear notches in this ear. Right ear is on pigs own right.

Individual Pig Marks: Left ear is used for notches to show individual pig number in the litter. Each pig will have different notches in this ear.

Notches are shown on this page for 149 litters. You can mark up to 161 litters with this system. Litter number and notches for that number are shown in each square.

96		114		132	
97		115		133	
98		116		134	
99		117		135	
100		118		136	

1		20		39		58		77		101		119		137	
2		21		40		59		78		102		120		138	
3		22		41		60		79		103		121		139	
4		23		42		61		80		104		122		140	
5		24		43		62		81		105		123		141	
6		25		44		63		82		106		124		142	
7		26		45		64		83		107		125		143	
8		27		46		65		84		108		126		144	
9		28		47		66		85		109		127		145	
10		29		48		67		86		110		128		146	
11		30		49		68		87		111		129		147	
12		31		50		69		88		112		130		148	
13		32		51		70		89		113		131		149	

14		33		52		71		90		Individual Pig Notches					
15		34		53		72		91		1		6		11	
16		35		54		73		92		2		7		12	
17		36		55		74		93		3		8		13	
18		37		56		75		94		4		9		14	
19		38		57		76		95		5		10		15	

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